N91-14974

THE ORIGIN OF THE GALACTIC EMISSION IN IRAS DATA

E. Caux*, P.M. Solomon** and T.J. Mooney**

*CESR CNRS/UPS, BP 4346, 31029 Toulouse Cedex, France.
**Astronomy Program, State University of New York at Stony Brook, New-York USA

Using the high resolution IRAS data in one hand, and the radial distribution of gaseous material and those of the interstellar radiation field (ISRF) in the other hand, we have built a model of the Galactic infrared emission.

The first step consisted of a separation of the diffuse emission in IRAS data from that of the well-defined strong Galactic sources. This was done using a morphologic separation of the two components based on their spatial distributions which are not the same in Galactic longitude as well as in Galactic latitude (Caux, Solomon and Mooney, in preparation).

A well accepted idea is that IR emission comes from dust heated either by the ISRF and/or by internal cloud heating sources. We have thus modelled the IR galactic emission from radial distributions of gas and ISRF and the following three main hypothesis : i/ The dust to gas ratio is the same in the whole Galaxy, ii/ IR emission is proportionnal to local dust density, iii/ IR emission is also proportionnal to the local ISRF.

For H1, we took Burton and Gordon (1978) radial distribution. The molecular material consists of two components, cold H2 (H2c) connected to molecular clouds having not or not yet formed high mass stars, and warm H2 (H2w) connected to active star forming regions associated with HII regions. We took the axissymetric distribution computed using FCRAO data (Solomon et al., private communication). The ISRF is derived from Innanen (1973) for the disc population and from the Lyman continuum photons distribution computed by Gusten and Mezger (1983) for star forming regions.

The IR emission as modelled in this way has been integrated over each line of sight and compared with observed IRAS data. The results show that the IR diffuse component emission comes from dust associated with H1 and heated by the general ISRF. For the dust embedded in cold H2 component, the heating source is also the general ISRF while the warm component is explained by dust embedded in molecular clouds and heated by high-mass stars born in the close vicinity of the clouds in one hand ($\approx$ 2/3) and by the disc population ISRF in the other hand ($\approx$ 1/3).

The table summarizes the different radial properties of each component. Total IR luminosities were computed using a bolometric correction determined by integration of IR spectra on a large sample of sources (λ > 120μm data are from Caux et al., 1985). IRE (ratio of IR luminosity over ionizing star luminosity) was computed using total IR luminosities (H1+H2c+H2w) and the number of Lyman continuum photons given by Gusten and Mezger, 1983. The main result is that we don't observe variations of IRE and $(L/M)_{H1}/(L/M)_{H2c}$ and $(L/M)_{H1}/(L/M)_{H2w}$ with galactic radius, showing that the physical properties of starlight to IR conversion are about the same in the whole Galaxy. The detailed results of this model will be given in a forthcoming paper (Caux, Solomon and Mooney, in preparation).

R (kpc)	L_{H1} (Lo/pc^2)	M_{H1} (Mo/pc^2)	$(L/M)_{H1}$	L_{H2c} (Lo/pc^2)	M_{H2c} (Mo/pc^2)	$(L/M)_{H2c}$
4.0-6.5	27.4	3.1	8.8	10.4	4.2	2.5
6.5-9.0	18.2	3.9	4.7	5.3	4.8	1.1
9.0-11.0	9.2	4.1	2.2	1.3	2.4	0.5
11.0-13.0	4.9	4.2	1.15	0.2	0.65	0.3
13.0-15.0	1.9	2.5	0.75	0.05	0.25	0.2

R (kpc)	L_{H2w} (Lo/pc^2)	M_{H2w} (Mo/pc^2)	$(L/M)_{H2w}$	$\frac{(L/M)_{H1}}{(L/M)_{H2c}}$	$\frac{(L/M)_{H1}}{(L/M)_{H2w}}$	IRE
4.0-6.5	45.6	6.1	7.5	3.5	1.2	15.2
6.5-9.0	8.0	2.1	3.8	4.3	1.2	15.0
9.0-11.0	0.2	0.15	1.3	4.4	1.7	15.6
11.0-13.0	-	-	-	3.8	-	-
13.0-15.0	-	-	-	3.8	-	-

References:

Burton, W.B. and Gordon, M.A. : 1978, Astron. and Astrophys. 63, 7.

Caux, E., Puget, J.L., Serra, G., Gispert, R. and Ryter, C. : 1985, Astron. and Astrophys. 144, 37.

Gusten, R. and Mezger, P.G. : 1983, Vistas in Astronomy, 26, 159.

Innanen, K.A.: 1973, Astrophysics & Space Science, 63, 7.